MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

TDS1191 – DISCRETE STRUCTURES

(TC02 / TT04)

11 MARCH 2016
9.00 a.m - 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **6** pages (inclusive of the cover page).
2. Answer **ALL** questions. The distribution of marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. Please write the answers for each question on a new page.
5. **NO CALCULATORS** are allowed in this exam.

QUESTION 1: SET, RELATION, FUNCTION, LOGIC (Total Marks: 10)

(a) A relation R is defined on the set of integer, Z where

$$R = \{(x, y) \mid x + y \geq 2\}$$

(i) Is R a partial order? Justify your answer.

(ii) Is R a function? Justify your answer. (2 + 2 = 4 marks)

(b) Given the predicate,

$Q(x, y)$: $xy = 1$ where $x \in Z$ and $y \in Z$

Determine the truth values of the following statements. Explain each of your answer.

(i) $\exists x\, Q(1, y)$

(ii) $\forall x \exists y\, Q(x, y)$

(iii) $\exists x \forall y\, Q(x, y)$ (2 + 2 + 2 = 6 marks)

Continued .....

QUESTION 2: RECURSION, INDUCTION, ALGORITHM (Total Marks: 10)

(a) Given the following mathematical statement:

$$3n \geq (1 + 2n) \qquad n \geq 1$$

(i) Show that the inductive base is true.

(ii) State the inductive hypothesis.

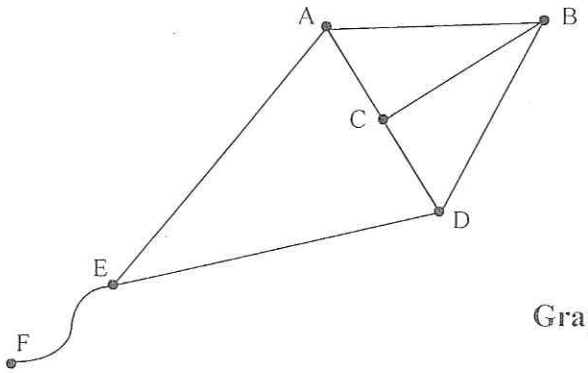
(iii) Show that the inductive step is true. (2 + 1 + 4 = 7 marks)

(b) Show that the average case complexity for $f(n) = 2n^2 + n$ is $\Theta(n^2)$. (3 marks)

Continued .....

QUESTION 3: GRAPH THEORY (Total Marks: 10)

Given the following Graph K,



Graph K

(a) Does Graph K have an Euler Circuit and/or an Euler Trail. Explain your reasons by referring to the Euler's Theorem.

(4 marks)

(b) With vertex A as the root, use the Breadth-First Search (BFS) algorithm to create a spanning tree for Graph K. Note that alphabetical ordering applies.

Use the table format as below:

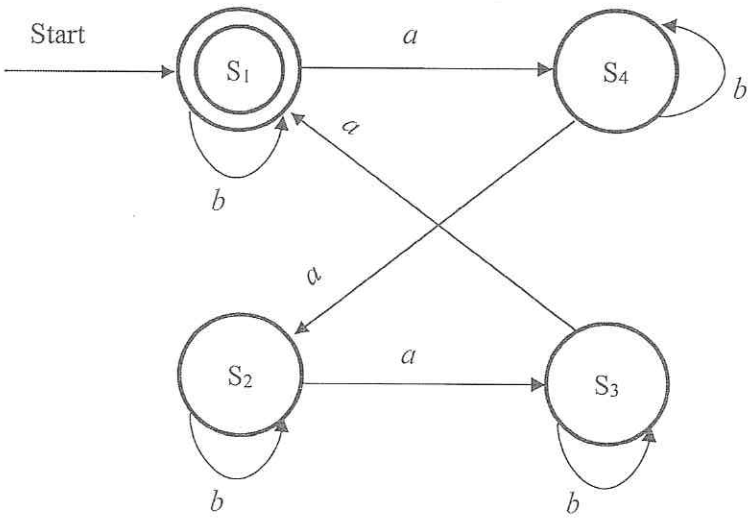
Iteration	Queue	Edges

(6 marks)

Continued .....

QUESTION 4: FINITE-STATE AUTOMATA (Total Marks: 10)

Given the following state transition diagram for a finite-state automaton, A:



(a) Create the state transition table for automaton A.

(b) Will automaton A accept the following input strings?

Input Strings	Decision
a a a a a a	
b b b b	
a b	

(c) State the language for automaton A.

(5 + 3 + 2 = 10 marks)

Continued .....

QUESTION 5: COMBINATORICS, BOOLEAN ALGEBRA (Total Marks: 10)

(a) Find how many different 6-digits numbers that can be created from the digits below:

3	3	4	5	5	5

(2 marks)

(b) Given the following Boolean expression:

$$\overline{x} \cdot \overline{y} \cdot z + x \cdot \overline{y} \cdot \overline{z} + x \cdot \overline{y} \cdot z$$

(i) Use Karnaugh map to simplify the Boolean expression.

(ii) Draw a logic circuit diagram for the simplified Boolean expression from part (i).

(4 + 4 = 8 marks)

End of Questions.

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